

REMARKS

After entry of the foregoing amendments to the claims, claims 1-22 will be pending. Claims 19-22 are new. Independent claims 1 and 14 (claim 14 is amended to become independent) and dependent claims 3, 7, 15, and 16 are amended. Support for the amendments can be found throughout the specification, and, for example, at ¶¶ 0037-0039. For example, the specification describes a flexible bag that decreases in volume as seawater flows into the buoyancy chamber and increases in volume to enable seawater to be pumped out. No new matter is added.

Objections to the Specification and Claims

The specification and claims are objected to as allegedly containing improper English spellings where British grammar is used. To obviate the objections, ¶¶ 0006, 0007, 0009, 0011, 0021, 0033, 0037, and 0045 of the as-published specification are amended to change the spelling of the words “maneuverability,” “behavior,” “meters,” and “pre-pressurized.” Also, claim 3 is amended to change the spelling of the word “utilized,” and claims 15 and 16 are amended to change the spelling of the word “pressurized.” No new matter is added. Applicant respectfully requests withdrawal of these objections to the specification and claims.

Claims 14-16 are objected to as being dependent on a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. To obviate these objections, claim 14 is amended to include all of the limitations of the base independent claim 1. Applicant respectfully requests withdrawal of these objections to claims 14-16.

Rejections under 35 U.S.C. § 112

Claim 7 stands rejected under 35 U.S.C. § 112, second paragraph, as allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Regarding the rejection of claim 7, the office action states that the limitation “the pressure differential there across” is not explicitly clear and does not have adequate antecedent basis. Claim 7 is amended to obviate the rejection by changing this limitation to recite “a pressure differential across the regenerative means.” Applicant respectfully requests withdrawal of this rejection of claim 7 under 35 U.S.C. § 112.

Rejections under 35 U.S.C. § 103

Finally, claims 1-13, 17, and 18 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over U.S. Patent No. 4,123,858 (“Batchelder”) in view of U.S. Patent No. 5,588,808 (“De Santis”). This rejection is traversed.

I. Element not taught by cited references

Independent claim 1, as amended, recites, in pertinent part, “volume varying means for defining a variable volume within the buoyancy chamber to allow a volume of seawater contained in the buoyancy chamber to vary.” Claim 1 is also amended to remove the power supply limitation, which Applicant believes is not necessary to distinguish over the prior art, and to clarify the meaning of the seawater inlet and the seawater outlet.

With regard to the term “volume varying means,” this element enables seawater to flow into, or be pumped out of the buoyancy chamber. In order to change the volume of the seawater in the buoyancy chamber by using a hydraulic pump, the seawater-containing capacity of the buoyancy chamber must be able to be varied in some way.

In the embodiment described in the as-published specification at ¶ 0037, the volume varying means is a gas-containing flexible bag 7, which may contract and expand due to pressure changes as seawater flows into and is pumped out of the buoyancy chamber, to vary the seawater-containing capacity of the chamber. The cylinder of pressurized gas 10 is only one way to help vary the volume in the flexible bag 7. In another embodiment described in the specification at ¶ 0039, the volume capacity of the buoyancy chamber may be varied by using a mechanical spring instead of a cylinder of pressurized gas 10.

Batchelder works in an entirely different manner than Applicant’s invention. Batchelder does not teach or suggest a volume varying means within the buoyancy chamber. Batchelder teaches discharging compressed air to blow the liquid out of the chamber. This is very different than Applicant’s invention, which uses a pump, assisted by a volume varying means, to push seawater out of the buoyancy chamber.

Adding the pump pressure multiplier of De Santis to Batchelder still does not teach or suggest a volume varying means within the buoyancy chamber. De Santis teaches a device for elevating a pressure acting on a liquid. Therefore, Batchelder, whether alone or in combination with De Santis, does not teach or suggest the claimed “volume varying means

for defining a variable volume within the buoyancy chamber to allow a volume of seawater contained in the buoyancy chamber to vary.”

Applicant further notes that the claimed “volume varying means” in claim 1 does not “read on” a device for discharging compressed air. The “volume varying means” instead encompasses the structure, material, or acts described in the specification and the equivalents thereof, which does not include the device disclosed by Batchelder. *See In re Donaldson Co.*, 16 F.3d 1189, 1193 (Fed. Cir. 1994) (“[O]ne construing means-plus-function language in a claim must look to the specification and interpret that language in light of the corresponding structure, material, or acts described therein, and equivalents thereof, to the extent that the specification provides such disclosure.”).

II. No motivation to combine the cited references

Also, given that Applicant’s invention operates in an entirely different manner than Batchelder, modifying Batchelder with the pressure multiplier of De Santis would not produce the applicant’s invention. As discussed above, Batchelder blows water out of the chamber using compressed air, while Applicant’s invention pumps seawater out of the buoyancy chamber.

The Office Action states in paragraph 7 that “the rationale [to add a pump pressure multiplier to Batchelder] would have been to provide a known, effective and reliable means to elevate water pressure in a predictable fashion to enhance the speed and effectiveness of pumping water for the purpose of buoyancy control.”

However, adding a pump (*e.g.*, from De Santis) to Batchelder would not produce Applicant’s invention. In order for the Batchelder device to blow water out of the chamber, the pressure in the chamber must exceed the pressure in the water outside the chamber. Applicant respectfully suggests that it is not reasonable to conclude that the pressure multiplier of de Santis would improve the speed and effectiveness of a compressed air system. If anything, adding a pump to the chamber outlet of Batchelder would slow down the system by impeding the ability of the compressed air to directly blow the water out of the outlet, and the system would become less efficient. Indeed, it is not even clear that the De Santis pressure multiplier would work at all in the context of such a compressed air system.

Furthermore, the hydraulic pumping system in Applicant's invention is quite different in operation than a compressed air system like Batchelder. In Applicant's invention, the cylinder of pressurized gas 10 is not used to expel the seawater from the buoyancy chamber. To clarify this point, the cylinder of pressurized gas 10 is not required for Applicant's invention to function properly. If the cylinder of pressurized gas 10 were not present, the volume varying means (*e.g.*, flexible bag 7) would still expand and contract due to pressure variations as seawater flows into and is pumped out of the buoyancy chamber. However, the work required to pump seawater out of the buoyancy chamber can be reduced if the pressure differential between the buoyancy chamber and the external seawater pressure is reduced. The cylinder of pressurized gas 10 allows this pressure differential to be reduced by injecting compressed air into the flexible bag 7 to raise the pressure in the buoyancy chamber. However, this is merely intended to reduce the work required of the pump. The compressed gas does not force seawater out of the buoyancy chamber, and the pressure in the buoyancy chamber is not raised above the external seawater pressure, as would be required in the compressed air system of Batchelder.

In this respect, as explained in the as-published specification at ¶ 0033, Applicant's invention may be operable at depths of 3,000 meters or greater. The pressure required to force water from a chamber at 3,000 meters or greater would be in excess of 300 bar. The energy required to provide compressed air (as in Batchelder) at these pressures would be extremely high, while a container suitable for containing air at these pressures would add considerably to the mass of the device. Both of these factors render a conventional compressed air system as disclosed in Batchelder, whether or not modified by De Santis, unsuitable for Applicant's device that is intended to be deployed at depths greater than hundreds of meters, such as the particular embodiment claimed in dependent claim 9.

New Claims

New dependent claims 19 and 21 further recite the embodiment wherein the "volume varying means" comprises a flexible bag containing a volume of gas and provided internally of the buoyancy chamber. The office action found claim 14 to contain allowable subject matter, and claim 14 recites a flexible bag provided internally of the buoyancy chamber and expanding means for causing expansion of said flexible bag. The volume varying means

recited in claim 19 is similar to the allowable subject matter in claim 14, and this limitation is not disclosed in Batchelder, whether alone or in combination with De Santis.

New dependent claim 20 recites the embodiment including “pressure balancing means” for increasing the pressure in the buoyancy chamber to thereby reduce the energy used by the hydraulic system for pumping seawater therefrom. New dependent claims 21 and 22 disclose wherein the pressure balancing means comprises a pressurized container for providing additional gas to the flexible bag (claim 21) and wherein the pressure balancing means comprises a mechanical spring (claim 22). As discussed above, Batchelder, on the other hand, teaches lowering the level of liquid within a chamber by discharging compressed air to force the liquid through an outlet of the chamber. Batchelder, whether alone or in combination with De Santis, does not teach or suggest increasing the pressure in the buoyancy chamber to reduce the energy used by the hydraulic system for pumping seawater. Rather, in Batchelder, discharging the compressed air is used to force the liquid through an outlet, not to reduce energy required to pump liquid through an outlet.

CONCLUSION

For at least the foregoing reasons, Applicant respectfully submits that independent claims 1 and 14 patentably define over the cited references and are allowable. As claims 2-13 and 17-22 ultimately depend from claim 1 and claims 15 and 16 ultimately depends from claim 14, Applicant further submits that the dependent claims patentably define over the cited references and are allowable. Applicant respectfully requests a notice of allowance for claims 1-22.

Respectfully submitted,

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